IN THE SPECIFICATION:

Please amend the specification according to the following:

I. In the Abstract (i.e., Page 7) of the Specification:

a. Please replace the paragraph comprising lines 1-18 with the following:

The invention relates to a method and computer readable medium for analyzing an object data set that includes points in a multi-dimensional space and in which a tubular structure occurs. The method including choosing a starting position in or near the tubular structure, deriving a cutting plane through the tubular structure at the starting position, determining a number of points forming part of the surface of the tubular structure in the vicinity of the starting position, and calculating a gradient to the surface for each of the points. The method further includes determining for each point a vector from the center of the tubular structure to the point, determining the angle between the vector and the gradient at the point, adding the point to a selection of points if the angle is equal to or smaller than a predetermined ceiling value, using the selection of points to calculate an orientation for the cutting plane such that the direction thereof is as parallel as possible to the longitudinal axis of the tubular structure at the starting position, and repeating the foregoing steps for a new starting position along the tubular structure as necessary.

II. On Page 1 of the Specification:

a. Please replace the paragraphs comprising lines 1-8 with the following:

The present invention relates to a method of analyzing an object data set ~~which~~ that comprises points in a multi-dimensional space and, in which a tubular structure occurs, ~~said~~ the method comprising the following steps:

a. choosing a starting position in or near the tubular structure;
b. deriving a cutting plane through the tubular structure at the starting position,
c. determining a number of points forming part of the surface of the tubular structure in the vicinity of the starting position; and
d. calculating a gradient to the surface for each of ~~said~~ the points.

b. Please replace the paragraphs comprising lines 10-18 with the following:

The international patent application ~~EP00/09505 (PHN 17.678) of the same applicant (not yet published)~~ PCT/EP00/09505 (WO 01/26055 A2), published 12 April 2001, relates to a method of the type mentioned above. This method generally relates to the analysis of a tubular structure in a multi-dimensional space. According to the method described in the cited international patent application EP00/09505 a self-adjusting probe is defined for analysis of the object data set. The self-adjusting probe comprises a sphere and a plane through the center of the sphere. The sphere should be positioned such that the tubular structure at least partially intersects the sphere. The plane should be oriented so as to be orthogonal to the tubular structure. When oriented correctly, the self-adjusting probe enables semi-automatic shape extraction of tube-like geometry.

III. On Page 2 of the Specification:

a. Please replace the paragraph comprising lines 24-34 with the following:

To this end, the method according to the invention also comprises the characterizing steps of:

e) determining for each point a vector from the center of the tubular structure to ~~said~~ the point;

f) determining the angle between ~~said~~ the vector and the gradient at ~~said~~ the point;

g) adding ~~said~~ the point to a selection of points if ~~said~~ the angle is equal to or smaller than a predetermined ceiling value;

h) using ~~said~~ the selection of points to calculate an orientation for the cutting plane such that the direction thereof is as parallel as possible to the longitudinal axis of the tubular structure at the starting position, and

i) repeating the steps a) through h) for a new starting position along the tubular structure if necessary.

IV. On Page 3 of the Specification:

a. Please replace the paragraph comprising lines 1-7 with the following:

A preferred version of the method also comprises the steps of: defining a sphere which is at least partially intersected by the tubular structure, and performing the steps

e) through g) only for surface points lying inside the sphere. When the radius of ~~said~~ the sphere is chosen wisely, for example, slightly larger than the expected radius of the tubular structure under analysis, points within ~~said~~ the sphere most likely belong to ~~said~~ the tubular structure whereas points outside ~~said~~ the sphere probably do not. Furthermore, the reduction of the number of points taken into account during the calculation also increases the calculation speed.

b. Please replace the sentence/para. comprising lines 16-17 with the following:

The invention ~~will be~~ is described in illustrative detail hereinafter with reference to the attached ~~drawing~~drawings, in which:

c. Please replace the sentence/para. comprising lines 18-19 with the following:

Figure 1 shows a cross section through two adjacent tubular structures under analysis by way of the method according to an aspect the invention~~.~~,

Figure 2 shows an example of an object data set with a tubular structure in which an illustrative aspect of the invention is indicated, and

Figure 3 shows an example of a flow chart of a method according to an aspect of the present invention.

d. Please replace the paragraph comprising lines 20-22 with the following:

Figure 1 shows a cross section through two adjacent tubular structures that is, vessels ~~1~~ 1 and ~~2~~2. A sphere ~~3~~ 3 is defined around the vessel ~~1~~1. The center of the sphere ~~3~~ 3 and the vessel ~~1~~ 1 coincide and is indicated as c. The sphere ~~3~~ 3 also partly intersects the vessel ~~2~~2.

e. Please replace the paragraph comprising lines 23-27 with the following:

The preferred version of the method according to the invention comprises the following steps. First a starting position is chosen in or near the tubular structure and a cutting plane is derived through the tubular structure at the starting position. These steps are also described ~~in more detail~~ in the international patent application EP00/09505 which document is incorporated completely herein by way of reference.

*f. **Please insert the following after line 27 and before line 28:***

Figure 2 shows an example of an object data set containing a tubular structure according to an aspect of the invention, and notably shows a tubular structure, in this case a rendition of a part of the vascular system of the patient to be examined, which has already been segmented from the possibly larger object data set. This is represented by step 10 in Figure 3. The segmentation consists, for example, in that all data values are set to a fixed value in positions in which the original object data set contains data values outside the selected range. The vascular system includes an aneurysm **13**, which acts as a reservoir, a blood vessel **12** that transports blood to the aneurysm **13** and a blood vessel **14** via which blood is discharged from the aneurysm **13**. The blood vessels **12** and **14** thus act as an inlet duct and an outlet duct. The starting point (**BP**) is selected by the user, for example by pointing it out on the display screen of a workstation by means of a mouse and/or a keyboard and a curser. Around the starting point **BP** there is taken a sphere (**B1**) as indicated in step 20. The gradients ($\mathbf{g}_{1j}$) of the data values are calculated at points on the edge of the tubular structure in the sphere **B1**; this is indicated in step 30. More explicitly the gradients are calculated as follows:

$$g_{1j} = \begin{pmatrix} \frac{\partial D}{\partial x_j} \\ \frac{\partial D}{\partial y_j} \\ \frac{\partial D}{\partial z_j} \end{pmatrix},$$ where (x_j, y_j, z_j) is the position at issue at the surface of the tubular structure and

D indicates the data-values of the data-set which represents, for example, the pixel-values or the voxel-values of the object to be examined. Consequently, the vector $\mathbf{g}_{1j}$ points transverse to the surface of the tubular structure. Subsequently, in step 40, the normal vector $\underline{\hat{n}_1}$ is calculated by means of a minimization process, so that the sum $\sum_j w_j \left(\hat{n}_1 * g_{1j}\right)^2$ is minimum. The weight factors w_j are to be adjusted by the user; preferably, the weight factors decrease as the distance between the position in which the gradient $\mathbf{g}_{1j}$ is calculated and the starting point **BP** is larger. The cutting plane **SN1** has a normal vector $\underline{\hat{n}_1}$ and extends through the starting point **BP**. The cross-section through the tubular structure **11** along the cutting plane

SN1 is taken in step 50. In step 51 the local diameter d of the tubular structure **11**, i.e. of the blood vessel, is derived from this cross-section. Furthermore, in step 52 the local center position of the tubular structure **11** is preferably derived from the cross-section as described in the international patent application EP00/09505.

In order to track the tubular structure as from the starting point **BP**, in step 60 the subsequent position **(VP)** is derived in the direction of the normal vector $\underline{\hat{n}_1}$, which is locally oriented accurately along the axis of the blood vessel. The magnitude of the shift is adjusted by the user in dependence on the degree of meandering of the tubular structure. Figure 2 shows a subsequent position **VP** that is reached after a large number of shifts along the axis of the blood vessel **12**. When the subsequent position is not yet the end position **(EP)** desired by the user, the steps **20**, **30**, **40**, **50**, **51**, **52** and **60** are repeated. Thus, the axis along the blood vessel and the diameter along the axis may thus be determined.

For example, the end point **EP** is the inlet point **(TP)** from the blood vessel **12** to the aneurysm **13**. The outlet point **(AP)** is reached by tracking the blood vessel from a different starting point **(BP')** on the blood vessel **14** by means of the procedure shown via Figure 3. For example, the user can terminate the tracking of the blood vessel when, on the basis of the anatomical insight of the user, the inlet point or outlet point has been reached. It is also possible to terminate the tracking of the blood vessel when the local diameter of the blood vessel suddenly increases strongly. A connecting line is drawn through the inlet point and the outlet point **(TP, AP)**. Furthermore, the central position **(Z)** of the aneurysm **13** is calculated as the center of gravity on the basis of the data values in the region **(G)**. The region **G** is, for example, a sphere around the aneurysm **13**. It has been found that suitable results are achieved for the center position **Z** when it is ensured that the region **G** does not include too many points in the segmented data set that lie outside the aneurysm. The normal vector $\underline{\hat{m}_1}$. It appears that this cutting plane **(SN3)** accurately separates the inlet and outlet ducts, in this case being the blood vessels **12** and **14**, from the aneurysm **13**.

V. On Pages 3 and 4 of the Specification:

a. Please replace the paragraph comprising lines 28-34 of p.3 and lines 1-9 of p.4 with the following:

~~Next~~With reference again to Figure 1, a number of points that form part of the surface of the tubular structure are defined in the vicinity of the starting position. In order to illustrate this step three points (also referred to as vertices) on the surfaces of the vessels are indicated. Point ~~4~~4 is a surface point on the vessel ~~1~~1. Points ~~5~~5 and ~~6~~6 are surface points on the vessel ~~2~~2. In the relevant art several methods are known to define the surface of a vessel in an object data set. When the object data set comprises a volumetric representation of the object by means of voxels, the surface of the vessel is defined by a set of boundary vessel voxels. This voxel set can be determined by first separating the vessel voxels from the tissue voxels by means of known techniques such as a 'region growing algorithm'. Next it is determined which of the vessel voxels lie adjacent to tissue voxels. Such voxels are referred to as boundary vessel voxels. Preferably this determination is performed by finding the facing neighbors, that is neighbors which have one voxel face in common. As an alternative the surface of the vessel can be represented by surface triangles which can be generated by means of the so-called marching cubes algorithm which is known in the art. The marching cubes algorithm is described, for example, in the article: "Marching Cubes: A High Resolution 3D Surface Construction Algorithm", by Lorensen and Cline, Computer Graphics, Vol. 21, No 4, July 1987.

VI. *On Page 4 of the Specification:*

a. Please replace the paragraph comprising lines 10-13 with the following:

In a next step gradient is calculated for each of the vessel surface points a gradient. This is performed by means of standard techniques, which are among others described in the international patent application EP00/09505. The resultant gradients for the points 44, ~~5~~5 and ~~6~~6 are indicated as ~~v4, v5 and v6~~ *v4*, *v5* and *v6*, respectively.

b. Please replace the paragraph comprising lines 17-19 with the following:

First for each point a vector is determined from the center of the tubular structure to ~~said~~ the point. For the point ~~4~~ 4 ~~said~~ the vector is designated as ~~vc4~~ *vc4*. For the point ~~5~~ 5 ~~said~~ the vector is designated as ~~vc5~~ *vc5*and for the point ~~6~~ 6 ~~said~~ the vector is designated as ~~vc6~~ *vc6*.

c. Please replace the paragraph comprising lines 20-26 with the following:

Next for each surface point the angle is determined between each of ~~said~~ the vectors and the gradient at ~~said~~ the point. If ~~said~~the angle is equal to or smaller than a predetermined ceiling value, ~~said~~the surface point is added to the above-mentioned selection of surface points to be used to orient the cutting plane. A ceiling value can be set by a user or can be automatically set. It has been found from experiments that a ceiling value of between 50 and 70 degrees, for example approximately 60 degrees, gives reasonable results in the case of the current example relating to shape extraction for a blood vessel.

d. Please replace the paragraph comprising lines 27-34 with the following:

Returning now to ~~figure~~ Figure 1 some calculations will be performed in order to illustrate the method according to the invention. Starting with the point ~~4~~4, the angle between ~~v4~~ *v4* and ~~vc4~~ *vc4* is zero degrees. Assume that the ceiling value is chosen to be 60 degrees. The point ~~4~~ 4 is then added to the selection. This is rightly so, because the point ~~4~~ 4 is a surface point on the vessel ~~1~~1, that is, the vessel under analysis. However the angle between ~~v5~~ *v5* and ~~vc5~~ *vc5* is more than 90 degrees. The point ~~5~~ 5 will, therefore, be excluded from the selection under the current conditions. Again this is correct, since the point ~~5~~ 5 is a surface point of the vessel ~~2~~2, that is, the vessel neighboring the vessel investigated.

VII. ***On Page 5 of the Specification:***

a. Please replace the paragraph comprising lines 1-6 with the following:

It is to be noted that the angle between ~~v6~~ *v6* and ~~vc6~~ *vc6* appears to be smaller than 60 degrees. The point ~~6~~ 6 would unintentionally be added to the selection, since the point ~~6~~ 6 is a surface point of the vessel ~~2~~2. This can be prevented by adding another criterion relating to the selection of vertices. A useful second criterion is that only surface points lying inside the sphere ~~3~~ 3 should be included in the selection. From ~~figure~~ Figure 1 it is clear that the point ~~6~~ 6 does not meet this criterion and would, therefore not be included in the selection after all.

VIII. ***On Page 7 of the Specification:***

a. Please replace the paragraph comprising lines 19-21 with the following:

The invention also relates to a computer program for carrying out the method according to the invention.

~~Fig. 1~~